

THE GENUS *BULIA* WALKER IN MEXICO
AND CENTRAL AMERICA

(Lepidoptera, Phalaenidae)

(PLATES 32, 33)

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Identification of a specimen of this group from the Allan Hancock Foundation collections as the previously unknown female of *Bulia mexicana* (Behr) has led to the examination of the genitalia of all the few known Mexican and Central American specimens of this genus. The surprising results necessitate this supplement to the author's previous revision. Full generic diagnosis is given in the 1936 papers, only the more salient features being given below.

Types of the two new species are from and therefore in the U.S. National Museum. Paratypes and authentic specimens of the other species except *morelosa* are in the Allan Hancock Foundation of The University of Southern California.

Bulia Walker

1858. *Bulia* Walker, Cat. Br. Mus., Lepid., 15: 1815, pro *Biula* Walker, *l. c.*, 13: 1169, 1857. Type: *propria* Walker, sole species.
1875. *Cirrhobolina* Grote, Trans. Amer. Ent. Soc., 5: 117. Contained *deducta* Morr. and *incandescens* n. sp., the latter a synonym of the former.
- 1936a. *Bulia*, Richards, Ann. Ent. Soc. Amer., 29: 431-437, 1 pl. (revision).
- 1936b. *Bulia*, Richards, Rev. d. Ent., 6: 343, 365-367, fig. 12 (in generic revision).
1939. *Bulia*, Richards, Ent. Amer., n.s., 19:5, 69-71, pl. 5, figs. 7-14.

Palpi with long second segment which is upcurved along the frons to the vertex or slightly above; third segment porrect and twice as long as broad (1936a, fig. 4). Head of male modified, frons with small tuberculate prominence, vertex with heavy sheaths enclosing specialized scales (1936a, figs. 3-4), these sheaths normally hidden by special scale tufts from frons and vertex. Head of female normal, frons rough, rounded out and with small tuft. Thorax, wing venation, legs, and abdomen normal

for group. Male genitalia symmetrical; uncus simple; both scaphium and subscaphium present and well developed; valves strongly sclerotized except apex of cucullus; clasper and ampulla absent; sacculus with basal lobe and distal prong exceeding cucullus; aedoeagus with one or two large spines on vesica in addition to microtrichiae; eighth abdominal sternite and tergite greatly reduced; pair of long invaginated scale-pouches on segment VIII. Female genitalia with sternite VII modified with apical indentation; sternite VIII absent.

This genus now contains 6 species and one race from southwestern United States, Mexico, Central America, northern South America, and the West Indies. All of these occur in Mexico and Central America. Only one species (*confirmans* Wlk.) can be identified with certainty without examination of the genitalia. The other 5 species vary greatly in color and pattern (partly sexual), but an idea of this range of variation can be had from the photographs in the author's 1939 paper. Though few specimens are known of 3 of the species, these specimens show enough intraspecific pattern differences to suggest that the wide variation known for *deducta* and *similaris* will be repeated in *mexicana*, *schausi*, and *morelosa*.

All specimens listed herein have been identified from genitalic slides except the unavailable types of *albina* Stkr. and part of the *confirmans* series.

All the Mexican and Central American females had mated, as shown by the presence of a spermatophore in the bursa copulatrix. Fig. 6 of pl. 33 is drawn deliberately from a virgin female, and over it has been superimposed the bursa of a mated specimen (dotted line). As this shows, virgin females have a smaller, definitely wrinkled bursa copulatrix which after mating is fully distended, smooth, and considerably larger.

KEY TO MALES

- A. Aedoeagus with only one large spine on vesica *schausi*
- AA. Aedoeagus with two large spines on vesica
 - B. Juxta with scobinate prongs *deducta*
 - BB. Juxta with rounded or squarish margin, without any special processes
 - C. Aedoeagus with spiculations on dorsal side near tip (in addition to those on vesica)

- D. Color dark, eastern, sexes alike . . . *similaris similaris*
 DD. Color light, western, female with reduced pattern . . .
 *similaris californica*
- CC. Aedoeagus without external spiculations
- D. Distal spine of aedoeagus less than one third length of proximal spine. Hind wing white . . . *confirmans*
 DD. Distal spine of aedoeagus over two thirds length of proximal spine. Hind wing with lunule yellowish *mexicana*

KEY TO FEMALES

- A. Sternite VII deeply indented, without median prong. Hind wing white *confirmans*
- AA. Sternite VII indented and with median prong. Hind wing with lunule yellowish
- B. Bursa copulatrix with heavily sclerotized area on side and around entrance of ductus seminalis. Prong of sternite VII very broad *schausi*
- BB. Bursa copulatrix without contrastingly sclerotized areas
- C. Median prong of sternite VII short and very broad. Bursa copulatrix weakly spined *mexicana*
- CC. Median prong of sternite VII narrower. Bursa copulatrix heavily spined
- D. Median prong of sternite VII long and narrow, considerably longer than lateral lobes of sternite . . . *deducta*
 DD. Median prong not or only slightly exceeding lateral lobes of sternite
- E. Median prong relatively narrow, lateral lobes broad and blunt *morelosa*
- EE. Median prong relatively broad, lateral lobes more acutely rounded
- F. Maculate like males, dark, eastern
 *similaris similaris*
- FF. More or less immaculate (unlike males), light, western *similaris californica*

Bulia confirmans (Walker)

1857. *Bolina confirmans* Walker, Cat. Br. Mus., Lepid., 13: 1157. Type locality: San Domingo. Type: ♀, British Museum.
1857. *Bolina umbrosa* Walker, Cat. Br. Mus., Lepid., 13: 1158. Type locality: San Domingo. Type: ♀, British Museum.
1857. *Biula* (sic) *propria* Walker, Cat. Br. Mus., Lepid., 13: 1170. Type locality: San Domingo. Type: ♂, British Museum.
1936. *Bulia confirmans* (Walker), Richards, Ann. Ent. Soc. Amer., 29: 433, figs. 1-2.
1939. *Bulia confirmans* (Walker), Richards, Ent. Amer., n. s., 19: pl. 5, figs. 7-9.

A small species with the color of the hind wing white, outer margin fuscous, and anal lunule white. Photographs of types in 1939 paper.

Expanse: 24-30 mm.

Male genitalia: (pl. 32, fig. 1) Sacculus with small basal lobe and very short distal production beyond cucullus. Juxta rounded. Aedoeagus with small distal spine on vesica and no external spiculations.

Female genitalia: (pl. 33, fig. 1) Sternite VII deeply indented at apex, without median prong, the indentation slightly surpassed by the sclerotized ductus bursae. Spines in bursa copulatrix weak.

Distribution: In Central America recorded only from Costa Rica (U.S.N.M.). Also recorded from Colombia (A.M.N.H.), Venezuela, British Guiana, Marguerite Island, San Domingo, Haiti, Jamaica, and Cuba (latter all in U.S.N.M.).

Bulia mexicana (Behr)

1870. *Syneda mexicana* Behr, Trans. Amer. Ent. Soc., 3: 27. Type locality: Casala, near Mazatlan, Sinaloa, Mexico. Types: both destroyed, topotypical neotype designated in following (in U.S. N.M.).
1936. *Bulia mexicana* (Behr), Richards, Ann. Ent. Soc. Amer., 29: 433.

Only 4 specimens are now known (exclusive of the lost types). The neotype is similar to typical *deducta* as figured in Ent. Amer., n. s., vol. 19, pl. 5, fig. 10, but somewhat lighter. The male from Costa Rica is much darker and similar to fig. 13, *l. c.* The female from Costa Rica is

also dark, the hind wing as in the male, the fore wing dark but with the maculation faint. The second female is lighter, the fore wing nearly immaculate except for the darker reniform and the light subterminal line; hind wing light but with broad dark band on outer margin to vein 2 (Cu_2).

Expanse: 33-35 mm.

Male genitalia: (pl. 32, fig. 7) Sacculus with small basal lobe and short distal production. Juxta rounded. Aedoeagus with both spines large, no external spiculations.

Female genitalia: (pl. 33, fig. 2) Sternite VII shallowly indented and with short, broad median prong which is not longer than the lateral lobes. Bursa copulatrix weakly spined.

Distribution: Types (lost) and 1 ♂ neotype from Mazatlan, Sinaloa, Mexico (neotype, December 20, 1916); 1 ♂, "Avangarez," Costa Rica, July (Schaus and Barnes) (in U.S.N.M.); 1 ♀, "Avangarez," Costa Rica, June (Schaus) (in U.S.N.M.); and 1 ♀, aboard ship bound from Corinto, Nicaragua, to White Friars, Mexico (islands opposite Petatlan Bay, Guerrero), February 8-14, 1932 (John S. Garth) (in Allan Hancock Foundation, The University of Southern California).

There is some question as to the exact location of "Avangarez," Costa Rica. Presumably this is the Abangares of the Pittier map of 1903 and the American Geographical Society map of 1937, but aside from the slight difference in spelling the older map locates this town at sea level at the mouth of the Rio Abangares, while the more recent map has nothing at this location but gives Abangares about 10 miles up the Rio Abangares at an elevation of about 600 feet (approximately Long. 85° W, Lat. $10^\circ 15' N$). Even so, both the evidence and Dr. Schaus' recollection place these specimens as from the Pacific slope at a low elevation. Mazatlan is at sea level, and of course the specimen taken aboard ship was at sea level. So all the known specimens come from at or near sea level on the Pacific slope from Mazatlan south to Costa Rica (Lat. 23° to $10^\circ 15' N$). No other species is known near sea level in this area.

***Bulia schausi*, new species**

Since this species can be separated satisfactorily only by genital structure, a formal description of the maculation is not given. The holotype male is similar to fig. 10 of pl. 5 of *Entomologica Americana*, volume 19, but the fore wing is less contrasty on account of blackish suffusion, the



t. p. line is rounded around the lower end of the cell instead of being angularly produced onto veins 3 and 4 (M_3 and Cu_1), the black t.p. line is outwardly faintly defined by white scales around the cell, and the hind wing has a yellow anal lunule which does not reach the margin at its upper end. The paratype male is much lighter, the black lines accordingly more distinct, t. a. line slightly more angulate inward in submedian fold, t. p. line defined outwardly by light scales both around cell and near inner margin, and the hind wing with the border lighter and narrower, barely defining the anal lunule. The allotype female has the fore wing grayish, similar to fig. 11 of pl. 5, *l. c.*, but even less maculate, hind wing with darker and broader border. The 3 paratype females are lighter, fore wing more brownish, and hind wing with reduced border. These differences could be summarized as: the 2 Tehuacan specimens moderately dark, the 4 Orizaba specimens light.

Expanse: 33-36 mm.

Male genitalia: (pl. 32, figs. 8-10) Basal lobe of sacculus slightly bilobed; distal projection of sacculus long. Juxta short, rounded, dorso-laterally developed to above aedoeagus (giving squarish appearance). Aedoeagus with only one large spine on vesica, and no external spiculations.

Female genitalia: (pl. 33, fig. 3) Sternite VII similar to that of *mexicana*, but the indentation slightly deeper. Ductus bursae short and with the 2 supporting sclerites of approximately equal length. Bursa copulatrix with 3 areas of heavy sclerotization (areas stippled in figure): one a curved cone around the entrance of the ductus seminalis, one opposite this merely a sclerotized area of the bursal wall, the third on the right side terminating anteriorly in a blunt prong; the last mentioned is also covered at its anterior end with small spiculations—too small to be shown in the figure; heavy spines in bursa as shown, no set of smaller spines in the middle of the bursa on the left side.

Holotype: ♂, Tehuacan, Puebla, Mexico, September, 1908 (R. Muller) (in U.S.N.M.).

Allotype: ♀, same data as holotype (in U.S.N.M.).

Paratypes: 1 ♂, 3 ♀, Orizaba, Vera Cruz, Mexico, no date (ex Schaus Coll., in U.S.N.M.).

Genitally this is the most distinct of all the species of the genus, differing among other points in having only one large spine in the aedoeagus of the male, and having a short ductus bursae and heavily sclerotized areas in the bursa copulatrix of the female.

The 6 types come from two localities which are only about 35 miles apart. Mr. H. R. Roberts tells me that these are both on the margin of the central plateau of Mexico in what is generally called a subtropical area. The town name alone is not definite, as a great range of altitude occurs within a few miles; even so, these localities are well removed both from low altitudes and from deserts.

Named in honor of Dr. William Schaus, who collected the paratypes and who has done more work on neotropical Lepidoptera than any other individual.

***Bulia morelosa*, new species**

Fore wing gray irrorated with dark gray. Faint double basal line; t. a. line black, double; median space concolorous with rest of wing except where crossed by the darker median shade line; reniform normal; t. p. line obsolete except near costa; subterminal line light, complete, defined by preceding and succeeding darker ground color. Hind wing and under sides as usual in genus; the dark border of the hind wing of moderate width.

Expanse: 30 mm.

Female genitalia: (pl. 33, fig. 5) Sternite VII deeply indented, with narrow blunt median prong and broad squarish lateral lobes. Other features as in *deducta* and *similaris* except that the unique mated female of *morelosa* has a rounded bursa copulatrix instead of constriction into 2 regions; this, however, might conceivably be an accident of either mating or manipulation during preparation of the slide.

Holotype: ♀, Cuernavaca, Morelos, Mexico, June, 1906 (ex Schaus Coll., in U.S.N.M.).

The town of Cuernavaca is on the southern and Pacific slope of the central plateau of Mexico. Although only a little more than a hundred miles from the localities where *schausi* was taken, Cuernavaca differs considerably from these localities, particularly in having some surrounding desert country. In keeping with this desert habitat (where the author assumes this specimen was collected), *morelosa* comes closest to the desert species of northern Mexico and southwestern United States. Of these large series are available, and sternite VII has been examined by the author on well over 200 specimens of *deducta* and on about 30 specimens of *similaris* (including race *californica*). None of these had this short but narrow median prong, and none such broad blunt lateral lobes. These

characters plus the wide spatial separation led the author to describe this unique as new.

***Bulia similaris* Richards**

1936. *Bulia similaris* Richards, Ann. Ent. Soc. Amer., 29: 433-434, figs. 8-9. Type locality: San Benito, Texas. Type: ♂, in U.S.N.M.
1939. *Bulia similaris* Richards, Ent. Amer., n. s., 19: 70, pl. 5, fig. 13.

The short type series, after segregation of race *californica*, shows a dark form in which the sexes are both maculate.

Expanse: 33-36 mm.

Male genitalia: (pl. 32, figs. 4-6) Sacculus with moderate basal lobe of somewhat variable shape, and blunt distal projection. Juxta moderate and smoothly rounded. Aedoeagus with moderate proximal spine on vesica and slightly larger distal spine; the dorsal surface near the tip covered with minute spiculations (in addition to spicules on vesica).

Female genitalia: (pl. 33, fig. 4) Sternite VII with relatively broad short median prong which is only slightly longer than the lateral lobes of the sternite.

Distribution: Texas, and Baboquivari Mountains, Arizona. Doubtless also occurs in northern Mexico, but no records are known.

***Bulia similaris* race *californica* Richards**

1939. *Bulia similaris californica* Richards, Ent. Amer., n. s., 19: 70-71, pl. 5, fig. 14. Type locality: Jacumba, San Diego County, California. Type: ♀, in U.S.N.M.

This is the desert race from the Pacific region. The females tend to be immaculate and light; the males are also lighter but not so strikingly so.

Expanse: 33-40 mm.

Genitalia: as in type form.

Distribution: Arizona, southern California, and Baja California, Mexico. From Baja California specimens have been seen from Rosarito (2 ♂, 1 ♀, paratypes), Punta Prieta (2 ♀, paratypes), and Espiritu Santo Island, March 7, 1937, John S. Garth Coll. (1 ♂, Allan Hancock Foundation Collection).

The greatest difficulty in this genus has always been and still is the separation of females of *similaris* (and *californica*) from those of *deducta*. As a rule, the median prong of sternite VII, being relatively short and

broad (*similaris*) or relatively long and narrow (*deducta*), will serve, but some specimens are more or less intermediate and so unplaceable unless accurately associated males are available. Even with males for identification, one must be careful because mixed lots from one collecting are not uncommon.

Bulia deducta (Morrison)

1874. *Syneda deducta* Morrison, Proc. Boston Soc. Nat. Hist., 17: 220. Type locality: Waco, Texas. Type: ♂, in Mus. Comp. Zool.
1874. *Syneda pavitensis* Morrison, Proc. Boston Soc. Nat. Hist., 17: 220. Type locality: Waco, Texas. Type: ♀, in Mus. Comp. Zool.
1875. *Cirrhobolina incandescens* Grote, Trans. Amer. Ent. Soc., 5: 117. Type locality: Texas. Type: ♀, in British Museum.
1882. *Cirrhobolina mexicana* var. *vulpina* Henry Edwards, Papilio, 2: 14. Type locality: Prescott, Arizona. Type: ♀, in U.S. Nat. Mus.
1900. *Syneda mexicana* var. *albina* Strecker, Lepid. Rhopal. Het. Ind. and Exot., Suppl. 3, p. 35. Type locality: Chihuahua, Mexico. Types: 2 ♀, in Field Museum.
- 1936a. *Bulia deducta* (Morrison), Richards, Ann. Ent. Soc. Amer., 29: 434-435, figs. 3-7.
- 1936b. *Bulia deducta* (Morrison), Richards, Rev. d. Ent., 6: fig. 12.
1939. *Bulia deducta* (Morrison), Richards, Ent. Amer., n. s., 19: pl. 5, figs. 10-12.

Extremely large series of this species are available, and the color and pattern of the types and most of the other known specimens of the preceding 4 species can all be matched fairly closely from these series (the females of *similaris* race *californica* do have an indescribably different "feel" that frequently but not always permits their separation). Photographs given in the author's 1939 paper (figs. 10-14) indicate this extensive range of variation though giving only five of the many types of variants.

Expanse: 33-38 mm. usually; extremes 30-40 mm.

Male genitalia: (pl. 32, figs. 2-3) Sacculus with large basal lobe (somewhat variable in shape), distal projection beyond cucullus long and pointed. Juxta (fig. 3) with long scobinated prongs which are characteristic of this species. Aedoeagus with 2 large spines, the distal one about half the size of the proximal one; in addition, a patch of medium-sized spines on the vesica near the proximal large spine, and small spiculations

elsewhere on the vesica; few small spiculations on exterior of aedoeagus near tip.

Female genitalia: (pl. 33, fig. 6) Sternite VII with long median prong which considerably surpasses the lateral lobes of the sclerite; this prong rather narrow and because of its length appearing relatively long and narrow in comparison to that of *similaris*.

Food plant: Mesquite (*Prosopis* sp.).

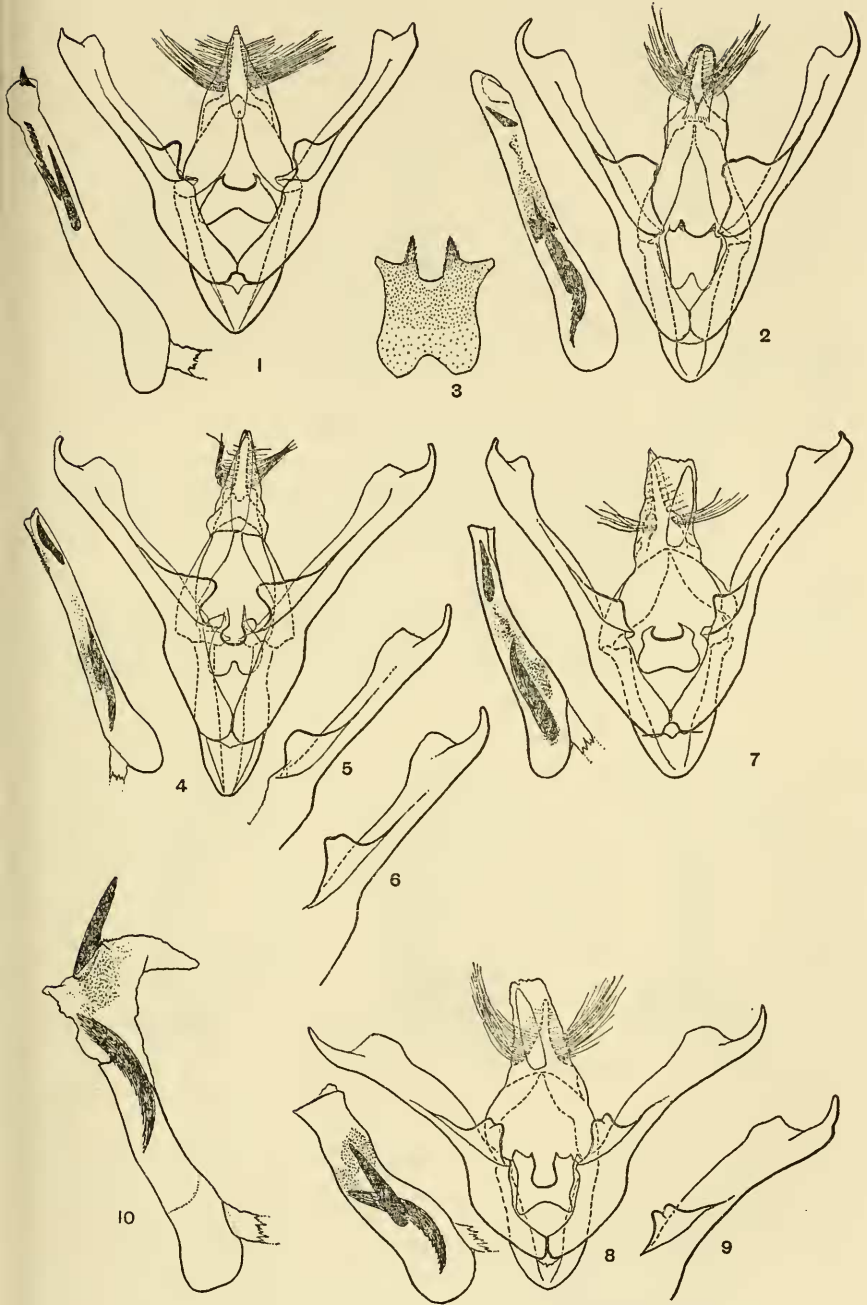
Distribution: Common in southwestern United States (Arkansas, Colorado, Texas, New Mexico, Utah, Arizona, and California). Only 4 Mexican specimens known to the author, though this species must occur generally throughout the dry areas of northern Mexico. 1 ♀, Copete Mine, 30 miles east of Carbo, Sonora, Mexico (A.M.N.H.); 1 ♂, Monterrey, Nuevo León, Mexico, November 25, 1909. F. C. Bishopp (U.S.N.M.); and the 2 female types of *albina* from Chihuahua, Mexico (Field Museum).

EXPLANATION OF PLATE 32

Male genitalia of the genus *Bulia* Walker

(All figures made with aid of camera lucida and at the same magnification except figure 3.)

- Figure 1. *Bulia confirmans* (Walker). Aedoeagus drawn alongside.
- Figure 2. *Bulia deducta* (Morrison). Aedoeagus drawn alongside.
- Figure 3. *Bulia deducta* (Morrison). Enlarged drawing of juxta (anellus).
- Figure 4. *Bulia similaris* Richards. Aedoeagus drawn alongside. Paratype.
- Figure 5. *Bulia similaris californica* Richards. Right valve only.
- Figure 6. *Bulia similaris californica* Richards. Right valve only.
- Figure 7. *Bulia mexicana* (Behr). Aedoeagus drawn alongside.
- Figure 8. *Bulia schausi*, new species. Aedoeagus drawn alongside. Holotype.
- Figure 9. *Bulia schausi*, new species. Right valve only. Paratype.
- Figure 10. *Bulia schausi*, new species. Aedoeagus with vesica distended. Paratype.



EXPLANATION OF PLATE 33

Female genitalia of the genus *Bulia* Walker

(All figures camera lucida and same magnification, all ventral views.)

- Figure 1. *Bulia confirmans* (Walker). Mated specimen.
- Figure 2. *Bulia mexicana* (Behr). Mated specimen.
- Figure 3. *Bulia schausi*, new species. Mated specimen. Lateral view of opening of ductus seminalis drawn alongside. Paratype.
- Figure 4. *Bulia similaris* Richards. Mated specimen.
- Figure 5. *Bulia morelosa*, new species. Mated specimen. Holotype.
- Figure 6. *Bulia deducta* (Morrison). Virgin; dotted line indicates silhouette of bursa copulatrix of a mated specimen superimposed on drawing of virgin.

